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ALABAMA POWER
A SOUTHERN COMPANY

January 12, 2017

U. S. Environment Protection Agency, Region IV
Air Planning and Implementation Branch
61 Forsyth Street, SW
Atlanta, GA 30303-8960

Alabama Department of Environmental Management
1400 Coliseum Boulevard
Montgomery, AL 36110-2059

Subject: Alabama Power Company – Gaston Steam Electric Generating Plant 1-hour SO2 Data Requirements Rule Modeling Report

Dear Sir/Madam,

The attached air dispersion modeling analysis was conducted in order to characterize sulfur dioxide (SO_2) air quality in the vicinity of Alabama Power Company's Gaston Steam Electric Generating Plant (Plant Gaston). This analysis is designed to fulfill the requirements of the United States Environmental Protection Agency's (EPA) final Data Requirements Rule (DRR) for the 2010 1-Hour SO_2 Primary NAAQS[1].

The enclosed modeling report was prepared in order to present the model results along with the methodology used to characterize SO_2 air quality in the vicinity of Plant Gaston. The modeling approach conforms to the applicable modeling procedures and guidance contained in the DRR, the draft EPA Modeling Technical Assistance Documents (TAD)[2], the final Plant Gaston modeling protocol submitted on September 30, 2016, and direction otherwise received from the Alabama Department of Environmental Management (ADEM).

The attached modeling report (along with modeling files included via web link) is being submitted on behalf of ADEM and is being sent electronically to the distribution list below.

Yours sincerely,

C. Mark Steele, Principal Engineer
Alabama Power Company - Environmental Compliance
cmsteele@southernco.com

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1 80 FR 51052, August 21, 2015 Federal Register Notice. Docket ID No. EPA–HQ–OAR–2013–0711.

2 Modeling Technical Assistance Document, EPA. 2014. Available at https://www.epa.gov/sites/production/files/2016-06/documents/so2modelingtad.pdf

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Modeling Report
Gaston Steam Electric Generating Plant
1-Hour SO_2 NAAQS Modeling

AECOM, Inc.
January 2017
Document No.: 60331751.6

Modeling Report
Gaston Steam Electric Generating Plant
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Reviewed By: Jeffrey Connors

AECOM, Inc.

January 2017

Document No.: 60331751.6

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1.0 Introduction

On June 2, 2010, the United States Environmental Protection Agency (i.e. the EPA) issued final revisions (75 FR 35520) to the primary National Ambient Air Quality Standards (NAAQS) for sulfur dioxide (SO_2). In the final rule, the EPA established a new primary 1-hour standard for SO_2 set at a level of 75 parts per billion (ppb). Also in the revision, the EPA revoked the two existing primary NAAQS (the 24-hour and annual standards) however; the secondary SO_2 NAAQS was not revised.

EPA is issuing area designations for the 1-hour SO_2 NAAQS in separate rounds. On August 10, 2015, as part of its implementation of the standard, the EPA issued the final Data Requirements Rule for the 2010 1-Hour Sulfur Dioxide Primary NAAQS[1] (e.g. "SO_2 Data Requirements Rule," or the "DRR"). The DRR directs state and tribal air agencies to provide data to characterize air quality in the vicinity of large sources of SO_2 emissions to identify maximum 1-hour SO_2 concentrations in ambient air. The air quality data provided pursuant to the DRR presumably will be used by the Alabama Department of Environmental Management (ADEM) and EPA in future actions regarding area designations as the agencies continue implementing the 1-hour SO_2 NAAQS.

In part, the DRR required air agencies to submit to EPA by January 15, 2016, a list identifying the sources in the state around which SO_2 air quality is to be characterized. This list must include sources located in areas that have not been designated nonattainment and have emissions greater than 2000 tons per year of SO_2 unless otherwise exempt (e.g. due to a unit retirement, fuel switch, permit limits, etc.). The DRR sets forth a process for two options air agencies may utilize to characterize air quality; by using either dispersion modeling of actual source emissions or by data from ambient air quality monitors. For each source on the list, air agencies are required to identify the approach (e.g. ambient monitoring or modeling) it will use to characterize air quality in the vicinity of the source unless the source chooses to adopt emission limits and thereby eliminate the requirement to characterize air quality.

In a letter to the EPA dated January 14, 2016, ADEM identified the sources in Alabama that have SO_2 emissions greater than 2000 tons per year for the most recent year for which emissions data were available (2014) and subject to the DRR. ADEM identified Alabama Power Company's (Alabama Power) Gaston Steam Electric Generating Plant (Plant Gaston) in Shelby County on this source list and ADEM opted to characterize air quality in the vicinity of Plant Gaston through modeling. Accordingly, a modeling protocol describing the proposed methodology for a 1-hour SO_2 NAAQS air quality dispersion modeling analysis was previously provided to ADEM on June 20, 2016, for forwarding to the EPA.

EPA has issued[2] a non-binding draft Technical Assistance Document (TAD) for modeling that set forth procedures for the modeling pathway. The current version of the modeling TAD references other EPA modeling guidance documents, including the following clarification memos; (1) the August 23, 2010, "*Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 NAAQS*", and (2) the March 1, 2011, "*Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard*" (hereafter referred to as the "additional clarification memo"). In the March 1, 2011, additional clarification memo, EPA declares that the memo applies equally to the 1-hour SO_2 NAAQS even though it was prepared primarily for the 1-hour nitrogen dioxide (NO_2) NAAQS.

EPA Region 4 provided comments on the protocol and all comments have been addressed or otherwise resolved in this final Plant Gaston modeling report. In addition, the modeling conforms to the applicable modeling procedures and guidance contained in the DRR, the August 2016, *"SO_2 NAAQS Designations*

[1] 80 FR 51052, August 21, 2015 Federal Register Notice. Docket ID No. EPA–HQ–OAR–2013–0711.

[2] Modeling Technical Assistance Document, EPA, 2014; Available at https://www.epa.gov/sites/production/files/2016-06/documents/so2modelingtad.pdf.

Modeling Technical Assistance Document"[2], and direction otherwise received from ADEM. This report presents the modeling results, methods and assumptions including model selection and options, meteorological data, and source parameters used in the modeling analyses that characterize 1-hour SO_2 air quality in the vicinity of Plant Gaston.

This document consists of the following three additional sections:

Section 2 - Facility Description and Emission Sources

Section 3 - Modeling Approach

Section 4 - Analysis of Modeling Results

2.0 Facility Description and Emission Sources

Plant Gaston is an existing Alabama Power electric power generating facility located in Wilsonville, Alabama, in Shelby County. The location of Plant Gaston is shown in Figure 2-1 and a near-field view of the plant is shown in Figure 2-2. The sources modeled for1-hour SO_2 concentrations in the vicinity of Plant Gaston are; four natural gas-fired boiler electric generating units (Units 1, 2, 3 and 4, or e.g. “Units 1-4”), one coal-fired boiler with supplemental natural gas-firing capability electric generating unit (Unit 5), and one small oil-fired combustion turbine (CT). The nominal rated electric generating capacities for Units 1-4 are 270 megawatts (MW) each, and 895 MW for Unit 5. The nominal rated capacity of the CT is 20 MW.

Units 1-4 were recently retrofitted to add natural gas burning capability as the primary fuel. The boilers for Units 1-4 share a common 749.3 foot tall stack that contains two flue gas stack liners. Exhaust flue gases from Units 1 and 2 share one stack liner and Units 3 and 4 share the second stack liner. The GEP stack height for the Units 1-4 stack is 555 feet (see Appendix A).

As noted, the Unit 5 coal-fired boiler has partial co-firing capability with natural gas. The exhaust flue gases from the Unit 5 boiler pass through electrostatic precipitators (ESPs) for particulate matter (PM) control, a selective catalytic reduction (SCR) system for NOx control, a baghouse (coupled with dry sorbent and activated carbon injection systems) for additional PM control and mercury emission control, and a flue gas desulfurization (e.g. FGD, or scrubber) system for SO_2 control before it exits from its 755 foot tall wet stack. Exhaust flue gases from Unit 5 may also be discharged upstream of the baghouse and FGD through a 750 foot tall dry stack (e.g. Unit 5 Bypass stack) potentially during periods of natural gas-only firing, during emergency situations, or at times the operator deems necessary in order to adhere to good engineering practices.

The CT is a simple cycle turbine with its flue gases emitting through a 25 foot tall stack.

Table 2-1 shows the physical stack parameters as applicable for the emission sources that were used in this modeling analysis. Units 1-4 were modeled using the recently permitted potential emission rates for natural gas-firing. The Units 1-4 exhaust flue gas stack parameters (velocity and temperature) for modeling are calculated engineering estimates that were used in the “Air Permit Application for the Natural Gas Project at Plant Gaston” that was submitted to ADEM under cover letter dated June 10, 2013. For Unit 5, the exhaust temperatures and flow rates were available from the continuous emissions monitoring systems (CEMS) database and used directly in AERMOD after converting the flow rate from standard cubic feet per minute to actual cubic feet per minute. The CEMS database was used for both the Unit 5 FGD and Bypass stacks. For the oil-fired CT, recordkeeping was utilized for times of operation, fuel consumption along with laboratory analysis for fuel btu value and sulfur content to calculate emission rates. Exhaust flow and temperature stack parameters for modeling the CT are based on manufacturer specifications.

A facility plot plan is provided in Appendix A.

Table 2-1 Physical Stack Parameters of Plant Gaston Modeled Emission Sources

Unit(s)	Location (UTM Zone 16 NAD 1983)		Basis for Modeled Emission Rate	Stack Base Elevation (ft)	Stack Height (ft)	Flue Diameter (ft)	Stack Exhaust Velocity (ft/s)	Stack Exit Temperature (°F)
	Easting (meters)	Northing (meters)						
Units 1-4	550,609.8	3,678,531.3	Permit(1)	424	555(2)	33.24(3)	85.7(1)	321.0(1)
Unit 5 (Bypass)	550,417.0	3,678,339.0	Actual(4)	433	750	30.00	Actual(5)	Actual(5)
Unit 5	550,227.0	3,678,273.0	Actual(4)	430	755	34.00	Actual(5)	Actual(5)
CT	556,382.0	3,678,599.0	Actual(6)	424	25	10.00	75.0(7)	837(7)

[1] Based on potential emission rates and engineering estimates utilized in the "Air Permit Application for the Natural Gas Project at Plant Gaston," submitted to ADEM under cover letter dated June 10, 2013

[2] The Units 1-4 GEP stack height was used

[3] Calculated equivalent diameter of the two liners in the Units 1-4 stack

[4] Actual hourly emission rates based on data from CEMS (2012-2014)

[5] Actual hourly velocity and temperature of exhaust is based on data from CEMS (2012-2014)

[6] Actual emission rate calculated from recorded operating time and fuel consumption along with laboratory analysis of btu value and sulfur content of the oil

[7] Data from manufacturer specifications

Figure 2-1 Location of Plant Gaston

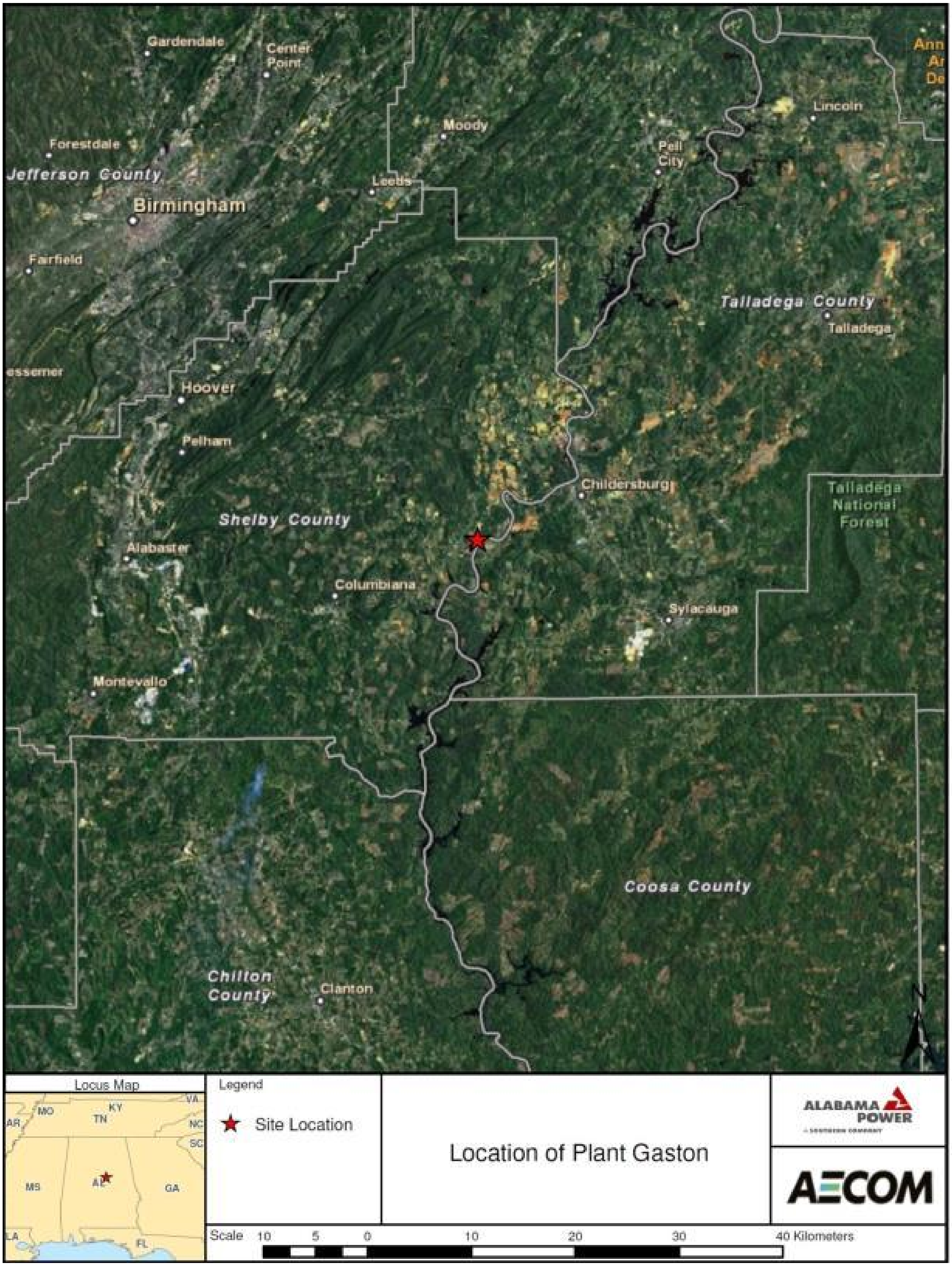
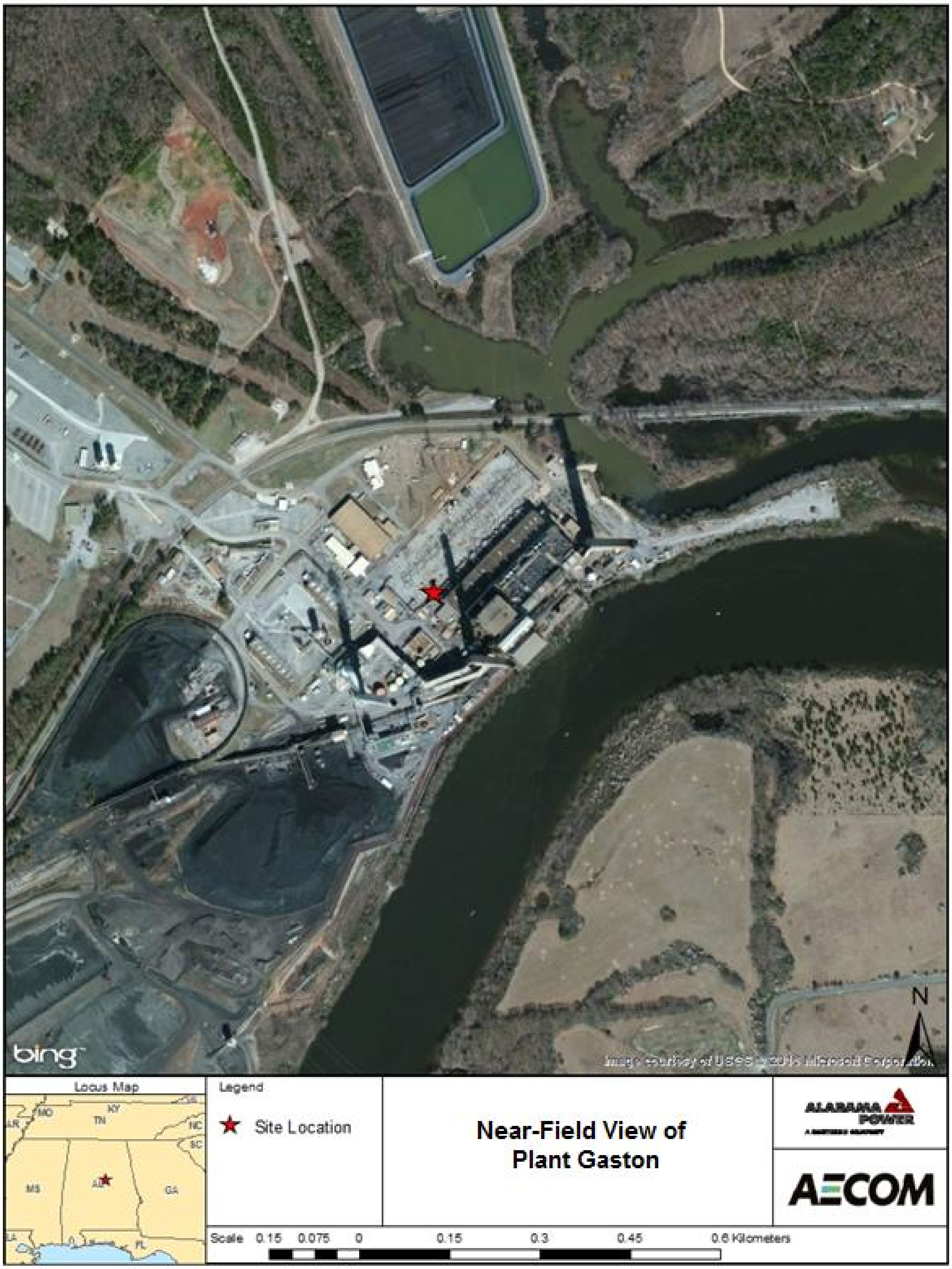


Figure 2-2 Near-Field View of Plant Gaston



3.0 Modeling Approach

3.1 Overview

This section presents the approach to the dispersion modeling analysis that was used for the 1-hour SO_2 modeling for Plant Gaston. The modeling approach was consistent with the guidance provided in the DRR, TAD where applicable, and direction received from ADEM. The following sections address each relevant portion of the modeling approach, including model selection, building downwash, terrain, meteorology, ambient air quality data, and background emission sources.

3.2 Model Selection and Options

AERMOD is EPA's recommended refined dispersion model for simple and complex terrain for receptors within 50 kilometers (km) of a modeled source. AERMOD is also capable of producing the statistical output required for the 1-hour SO_2 NAAQS. As such, AERMOD Version 15181 (released June 30, 2015) was used for this analysis using default model options.

Figure 3-1 shows that the area surrounding Plant Gaston is predominantly rural. Therefore, the urban source option in AERMOD was not used.

3.3 Building Downwash

EPA modeling guidelines require the evaluation of the potential for physical structures to affect the dispersion of emissions from stack emission points. The exhaust from stacks that are located within specified distances of buildings, and whose physical heights are below specified levels, may be subject to "aerodynamic building downwash" under certain meteorological conditions. If this is the case, a model capable of simulating this effect must be employed.

The analysis used to evaluate the potential for building downwash is referred to as a physical "Good Engineering Practice" ("GEP") stack height analysis. Stacks with heights below physical GEP are considered to be subject to building downwash.

The physical height of the stack servicing Plant Gaston's Units 1-4 is 749.3 feet (ft). The GEP controlling structure for Gaston Units 1-4 is the boiler house for Unit 5 and associated electrostatic precipitator (height of 222 ft with a projected width greater than the height). Therefore, the GEP stack height is 555 feet (2.5 x 222 ft). The GEP stack height of 555 ft was established in a letter dated December 31, 1985, from Mr. W. L. Bowers of Alabama Power to Mr. Richard E. Grusnick of ADEM. A copy of this letter is attached in Appendix B.

The physical height of the stack servicing Plant Gaston's Unit 5 wet stack is 755 ft. The physical height of the Unit 5 Bypass stack is 750 ft. The Unit 5 stack is grandfathered as was established in a letter dated December 31, 1985, from Mr. W. L. Bowers of Alabama Power to Mr. Richard E. Grusnick of ADEM. A copy of this letter is attached in Appendix B.

The DRR and TAD allow modeling to be conducted using actual stack heights. However, based on guidance in the TAD, Units 1-4 were modeled using the GEP formula stack height of 555 ft as the emissions are based on recently permitted potential emission rates for natural gas-firing. Unit 5 was modeled using actual hourly emissions, and as such, was modeled using the physical stack height of 755 ft for the FGD wet stack and 750 ft for the Bypass stack since it is a grandfathered stack. Finally, the physical stack height of the CT was also used since its physical height is less than the GEP formula stack height.

The effects of building downwash were incorporated into the modeling analysis using the latest version of EPA's Building Profile Input Program software (BPIP PRIME Dated 04274) to calculate the direction-specific building dimensions for input to AERMOD. Figure 3-2 shows the locations of the modeled stacks and buildings that were used as input to BPIP.

3.4 Terrain and Receptor Processing with AERMAP

EPA modeling guidelines require that the differences in terrain elevations between the stack base and model receptor locations be considered in the modeling analyses. There are three types of terrain:

- simple terrain – locations where the terrain elevation is at or below the exhaust height of the stacks to be modeled;
- intermediate terrain – locations where the terrain is between the top of the stack and the modeled exhaust "plume" centerline (this varies as a function of plume rise, which in turn, varies as a function of meteorological conditions);
- complex terrain – locations where the terrain is above the exhaust plume centerline.

Based on a review of the United States Geographical Survey (USGS) topographical maps, the area in the vicinity of Plant Gaston is generally characterized as simple terrain relative to the modeled stacks.

A comprehensive Cartesian receptor grid extending to approximately 15 km from Plant Gaston was used in the AERMOD modeling to assess ground-level SO_2 concentrations. The 15-km receptor grid was more than sufficient to resolve the maximum impacts and any potential significant impact area(s).

The Cartesian receptor grid consisted of the following receptor spacing:

- From the center of the plant (UTM northing = 3,678,300 meters and UTM easting = 550,000 meters) out to a distance of 3000 meters (m) at 100-m increments
- Beyond 3,000 m to 5000 m at 250-m increments
- Beyond 5,000 m to 10,000 m at 500-m increments
- Beyond 10,000 m to 15,000 m at 1000-m increments

Receptors were placed at a minimum of 100-m intervals along the ambient air boundary. Figure 3-3 shows the modeling boundary consisting of natural barriers and controlled and/or patrolled areas. Below is a description of the various segments of the ambient air boundary for the plant site:

Segment 1 Runs along the river shore line from a point southeast of the coal pile to the southeast property boundary corner. River banking is very high (50+ feet) on the northern end of the segment (#1a) with a marsh and heavy vegetation on the southern end (#1b). Segment 1 has a road along the shore line, and is patrolled and not fenced.

Segment 2 Starting from the southern end point of Segment 1, following west along the southern property boundary. At the southwest property corner, turn north following a route to the railroad. The southern property section has heavy vegetation with road access. There is a road adjacent to the long north-south section of the segment. Segment 2 is patrolled and fenced.

Segment 3 From the northern end of Segment 2 following northeast along the railroad to a point where the northern railroad spur approaches. Segment 3 has a road adjacent to the entire segment with "Private Property, No Trespassing" signage. Segment 3 is patrolled and not fenced.

Segment 4 Starting from the northeast end of Segment 3 following north along the west side of the railroad spur to a point approximately 400 feet from Highway 25. This railroad spur is dedicated to plant activities. A road runs adjacent to this segment. Segment 4 is patrolled and fenced.

Segment 5 Starting from the end of Segment 4 on to the property boundary along Highway 25. There is a large earthen embankment along the southern-most section of this segment that adjoins to Segment 4 (#5a). Once reaching Highway 25, the segment follows the highway northeast passing the front entrance to the plant, then turning south along the property line for approximately 300 feet. Then turn east along the property line for approximately 1000 feet. Aside from the main entrance, there is a plant contractor's entrance on this segment with both roads having appropriate signage (#5b). The transmission line right-of-way that crosses the boundary near where Segment 6 begins has a cable wire barrier (#5c). The remainder of the northern part of Segment 5 has heavy vegetation with "Private Property, No trespassing" signage (#5d). Segment 5 is patrolled and not fenced.

Segment 6 Starting from the northeast end point of Segment 5 following the property boundary east (turning north, east then north again) then along Highway 25 to the end of the gypsum pond. Segment 6 has vegetation barriers, is patrolled and fenced.

Segment 7 Starting from the end of Segment 6 following the property boundary southeast to Yellowleaf Creek. Follow the creek shore line property boundaries to a point near the plant parking area. Segment 7 has vegetation and marsh areas. Segment 7 has roads to the shore line, is patrolled and is not fenced.

Segment 8 Starting from the end of Segment 7 following the creek shore line. At a point approximately halfway the length of the peninsula between the creek and the river, cut south across the peninsula to the river shore line. Follow the river shore line southwest to the beginning of Segment 1. The entire length of Segment 8 has adjacent road access, is patrolled and fenced.

The modeling boundary has excellent road accessibility and is patrolled at a frequency rate of 15+ times per day.

The AERMAP domain corresponds to a 1.5-km buffer beyond the receptor grid and provides sufficient resolution of the hill height scale required for each receptor. A larger buffer was not necessary as there are no significant terrain features just beyond this distance. Terrain elevations from the NED acquired from USGS[3] were processed with the most recent version of AERMAP (version 11103) to develop the receptor terrain elevations and corresponding hill height scale required by AERMOD. The NED file is referenced to Datum NAD83 (note all source locations and receptors are referenced to NAD83 UTM Zone 16). The NED files are included in the electronic modeling archive (see Appendix C) that is submitted along with this final modeling report. The extent of the receptor grid is shown in Figure 3-4 (near-field) and Figure 3-5 (far-field).

3.5 Meteorological Data for Modeling

No on-site meteorological data is available, so the application of a refined dispersion model requires multiple years of hourly meteorological data that are representative of the model application site. In addition to being representative, the data must meet quality and completeness requirements per EPA guidelines. Per Appendix B of ADEM's PSD Air Quality Analysis – AERMOD Modeling Guidelines, surface data from Birmingham-Shuttlesworth International Airport in Alabama was used in the modeling analysis. Birmingham-Shuttlesworth International Airport is located approximately 27 miles northwest of Plant Gaston.

[3] http://seamless.usgs.gov/index.php

The following statement is taken from ADEM responses to EPA comments regarding 1-hour SO_2 DRR modeling. ADEM's justification for use of meteorological data from Birmingham-Shuttlesworth International Airport for modeling is as follows:

> *"This data has historically been used to characterize modeling for this facility for the past few years. There have not been any geographical changes in the area that would deem this NWS site unrepresentative. There are no other new datasets nearby that would better represent this location. NWS surface and upper air sites are limited in this area. Furthermore the data map below has been used to determine met data for PSD for decades. This data is typically determined on an application by application basis. Below is ADEM's section of the guidance document that addresses representativeness.*
>
> *The following Meteorological PSD Data Map [Figure 3-6] was used to identify the area of the State in which the proposed new source or modified source will be located to determine which National Weather Service (NWS) station data to use in the modeling. The station identification numbers are also indicated.*
>
> *The map of Alabama modeling domains was broken out into 12 sections. These sections were determined by average monthly precipitation, average monthly mean temperature and topography. In each county, a COOP weather station was chosen and a 30 year (some stations less than 30) monthly average rainfall and monthly mean temperature was compared to the 12 surrounding NWS stations monthly data. The NWS station that correlated the closest to the COOP station was linked to that county. Once all the counties were looked at, they were grouped together by NWS station. The regions were adjusted to account for the various topographical differences across the state of Alabama."*

As such, per ADEM guidance, three contiguous years of data from Birmingham-Shuttlesworth International Airport (2012-2014) with concurrent upper air data from Shelby County Airport in Alabaster, Alabama, as provided by ADEM, was used in the analysis. The pre-processed meteorological data (profile and surface files) for use with AERMOD that was provided by ADEM was processed with the latest version of AERMET (version 15181). The locations of Birmingham-Shuttlesworth International and Shelby County airports relative to the location of Plant Gaston are shown in Figure 3-7. The meteorological station information can be found in Table 3-1.

Table 3-1 Meteorological Stations used for Modeling

Met Site	Latitude	Longitude	Base Elevation (ft)	Station Call Sign
Birmingham-Shuttlesworth International Airport	33.5639	86.7523	615.2	KBHM
Shelby County Airport	33.1778	86.7832	650.0	KEET

Source: AIRNAV.com

3.6 Ambient Monitoring Data

As part of the 1-hour SO_2 modeling analysis, ambient background was added to the modeled concentrations. For this analysis ADEM has directed the use of ambient data from the Centreville, Alabama, monitor for the period of 2012-2014 to be consistent with the meteorological years proposed for modeling. From their response to EPA's comments on the modeling protocol for Plant Gaston, ADEM's justification for the use of the Centreville monitor is as follows:

> *"The 1-hour SO_2 background values used for this analysis were derived from data collected at the Centreville, Alabama, SEARCH site. The Centreville SEARCH site is considered to be representative of background SO_2 concentrations based on a number of factors. The data from this SEARCH site has very little impact from anthropogenic sources, therefore, it should be representative of background 1-hour SO_2 values for most areas of the State of Alabama. The purpose of adding the background value to the final model-predicted concentration is to account for the potential impact of sources outside the scope of the modeling analysis, such as natural and distant sources, which may minimally impact air quality in the area. Due to the fact that an inventory of sources is modeled in addition to the source under review, there is a high possibility that the air quality impacts from many sources could be double-counted when the background value is added to the final 1-hour SO_2 concentration predicted by the model.*
>
> *Other monitors located outside the State were considered as possible background sites, but due to the proximity of alternative monitors to urban areas and anthropogenic sources, these monitors would not provide an appropriate background concentration. Using concentrations from urbanized/ industrialized areas can unduly influence the monitors and not provide a value that is truly representative of background conditions in a rural area. These areas tend to be more populated and urbanized, which is not representative of rural areas such as the Gaston area. These monitors are likely impacted by urban influences and would not be representative of the rural background conditions in Gaston, Alabama.*
>
> *Additionally, due to the Centreville site's location relative to Gaston, the synoptic-scale weather conditions in the Centreville area would be very similar to the Gaston area. Most major weather systems that would impact the Gaston area would, in general, impact the Centreville area as well. Due to all the factors cited above, ADEM determined that the Centreville, Alabama, site was the appropriate background monitor to use for this analysis."*

Design concentrations for the period of 2012 through 2014 are provided for this monitor in Table 3-2. The design concentration is based on the 99^{th} percentile of the peak daily 1-hour SO_2 concentrations averaged over three years as provided by ADEM.

Table 3-2 1-Hour SO_2 Design Concentrations for the Centreville Monitor

Monitor	Year	99^{th} Percentile Concentration (ppb)	Design Concentration (3-year average)	
			ppb	µg/m^3
Centreville	2012	20	17	44
	2013	9		
	2014	22		

According to EPA guidance documents, the combining of the modeled plus monitored concentrations can consider the following options:

Option 1: The design concentration from Table 3-2 would be added to every hour of modeled concentrations to determine the total concentration, as referenced in Section 8 of the SO_2 Modeling TAD.

Option 2: Seasonal and hour of day varying background concentrations would be calculated in accordance with EPA guidance in the March 1, 2011, additional clarification memo[4]. The matrix of seasonal and hour of day varying background concentrations would be combined with the modeled concentrations on an hourly basis within the AERMOD modeling system using the SEASHR keyword in the SOURCE input pathway.

Option 3: Would include seasonal and hour of day varying background concentrations as described above, but hours in which the source clearly influence the monitor would be removed from the database prior to calculating the seasonal and hour of day varying background concentrations. This procedure would follow guidance in Section 8.2.2 of the Appendix W of the GAQM. Section 8.2.2 of Appendix W states *"Use air quality data in the vicinity of the source to determine the background concentration for the averaging times of concern. Determine the mean background concentration at each monitor by excluding concentrations when the source in question is impacting the monitor… For shorter time periods, the meteorological conditions accompanying concentrations of concern should be identified. Concentrations for meteorological conditions of concern, at monitors, not impacted by the source in question, should be averaged for separate averaging time to determine the average background value. Monitoring sites inside a 90° degree sector downwind of the source may be used to determine the area of impact."* This approach is also referenced in Section 8 of the SO_2 Modeling TAD. Similar to Option 2, the matrix of seasonal and hour of day varying background concentrations would be combined with the modeled concentrations on an hourly basis within the AERMOD modeling system using the SEASHR keyword in the SOURCE input pathway.

Option 2 was utilized in the 1-hour SO_2 modeling for Plant Gaston. As such, three years (2012-2014) of hourly SO_2 monitoring data from the Centreville monitor were obtained from ADEM and then used to calculate season and hour of day varying background concentrations in accordance with the EPA guidance in the March 1, 2011, additional clarification memo. The database of seasonal and hour of day varying background concentrations includes a matrix of 96 hourly concentrations used as input to the model (96 = 4 seasons x 24 hours per day). Each of the 96 background concentrations was determined from a potential of 90-92 valid observations depending on the number of days in the season. After accounting for the invalid and missing data, the range of valid observations was 46 to 92 depending on the season and hour or day. Most season and hour of day "bins" have 80+ valid observations per year with the exception of 2012 during hour six in the summer and fall which each had 77 and 75 observations respectively Also, hour 21 for all four seasons and years had closer to 50 valid observations. Nonetheless, these counts in valid observations resulted in the 99^{th} percentile equaling the 2^{nd} highest observations for each season and hour to be consistent with the EPA March 1, 2011, Guidance. Any season and hour with less than 50 valid observations used the 1^{st} highest concentration. Table 3-3 shows the resultant seasonal and hour of day varying background used as input to AERMOD.

[4] http://www.epa.gov/ttn/scram/guidance/clarification/Additional_Clarifications_Appendix W_Hourly-NO2-NAAQS_FINAL_03-01-2011.pdf

Table 3-3 Centreville Monitor – 2012-2014 Season and Hour of Day Ambient Background (ppb)

Hour of Day	Season 1	Season 2	Season 3	Season 4
	(Dec-Jan-Feb)	(Mar-Apr-May)	(Jun-Jul-Aug)	(Sep-Oct-Nov)
1	3.4	2.1	1.7	1.5
2	4.0	2.3	2.6	2.0
3	3.0	1.9	2.8	2.6
4	2.5	1.9	2.5	3.9
5	3.5	1.5	2.3	6.5
6	5.1	1.7	3.2	7.8
7	6.9	1.9	5.4	7.7
8	6.2	2.7	7.6	8.8
9	5.5	5.5	7.4	9.8
10	3.5	3.8	5.8	10.7
11	4.0	3.1	6.5	4.9
12	4.7	2.6	2.7	3.5
13	3.1	2.4	3.2	4.1
14	2.9	3.1	3.0	2.4
15	3.2	3.3	2.5	2.0
16	3.3	2.8	1.8	2.0
17	3.7	2.9	1.5	2.5
18	2.7	3.0	1.7	2.9
19	3.3	2.6	1.9	2.6
20	2.3	2.3	1.9	1.9
21	2.5	2.3	2.4	2.1
22	2.8	1.8	1.5	1.9
23	3.7	2.7	1.7	2.3
24	3.4	2.6	1.2	2.3

3.7 Nearby Sources

ADEM evaluated a list of background sources that had the potential to be included in the modeling. From their response to EPA comments on modeling protocols for Alabama sources, ADEM provided the following justification for the methodology used in the selection of sources near Plant Gaston:

> *"ADEM evaluated sources within a 20 km area surrounding the eight facilities who elected to following the modeling pathway for compliance under the SO_2 1 hour Data Requirements Rule. ADEM believes that this is a reasonable starting point for evaluation of sources and does not preclude sources from choosing alternate screening criteria that include/exclude sources. A spreadsheet provided each facility with the facility(ies) that met the 2014 actual emissions (in tpy) divided by the distance of greater than 20 within a maximum distance of 20 km. This did include small sources at very close distances. This information will be well documented in the final submittals due to EPA by January 13, 2017. Again, the metric ADEM used to develop the preliminary additional source(s) to be evaluated for inclusion in the modeling for the eight DRR subject sources choosing to model is as follows:*
>
> *ADEM Metric: Q/D > 20 within 20 km*
>
> - *First, ALL sources within 20 km of each facility were pulled,*
> - *Next, a Q/D value was developed for each facility on the list, where Q represents the 2014 actual SO_2 tpy emissions totals, and D represents the distance between the two facilities,*

- *If the Q/D metric yielded a value of greater than 20, the facility was retained and additional QA/QC was performed on a unit by unit basis."*

ADEM's list of nearby background sources for Plant Gaston modeling is in Table 3-4. Alabama Power agrees that ADEM's methodology for nearby source selection is reasonable and an alternate screening criterion is not necessary.

Based on their review utilizing the above criteria, ADEM identified one additional facility to be included as a background source in the Plant Gaston 1-hour SO_2 modeling. The identified source is Resolute Coosa Pines, located near Harpersville, Alabama, in Talladega County. The location of Resolute Coosa Pines relative to Plant Gaston is depicted in Figure 3-8.

ADEM also provided stack parameter data and the modeled emissions rate for Resolute Coosa Pines. This data is listed in Table 3-5 and is included in the Plant Gaston modeling.

Table 3-4 ADEM List of Nearby SO_2 Sources

Facility Name	2014 SO_2 Emissions (tpy)[(1)]	Direction from Gaston	Distance (km)	Q/D
Resolute Coosa Pines	349	NE	12.8	27

Table 3-5 Stack Parameters for Resolute Coosa Pines

Model Stack ID	Base Elevation (m)	Stack Height (Actual) (m)	Stack Top (m)	Exit Diameter (m)	Exit Temp. (K)	Exit Velocity (m/s)	SO_2 Modeled Emission Rate (g/s)
RSCP	128.63	60.96	189.59	3.00	457.6	27.78	0.479

Figure 3-1 Land Use within 3 km of Plant Gaston – Aerial Photo

Figure 3-2 Plant Gaston Buildings and Stacks used for the BPIP Analysis (looking north)

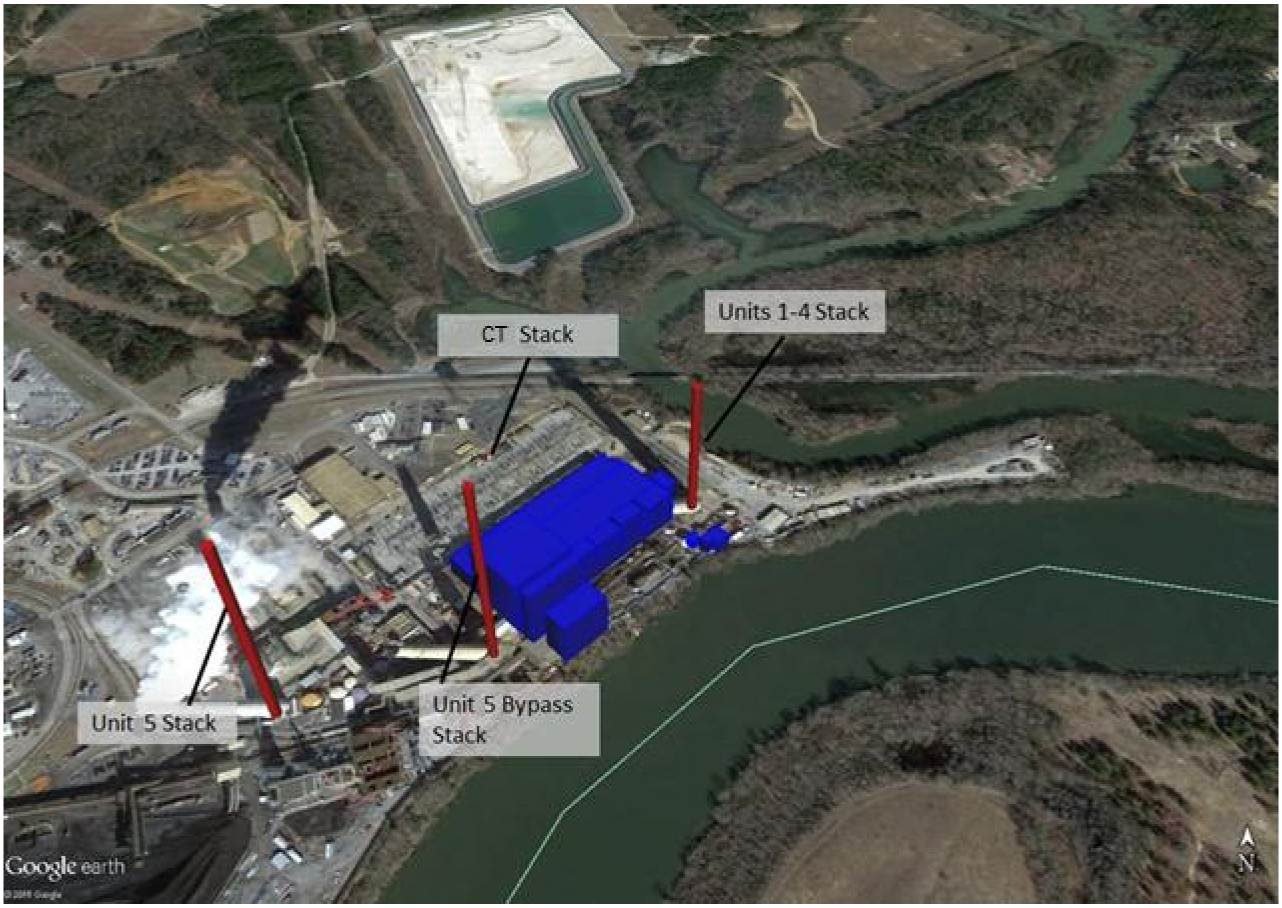


Figure 3-3 Plant Gaston Ambient Air Boundary

Figure 3-4 Near-Field Receptor Grid for Plant Gaston

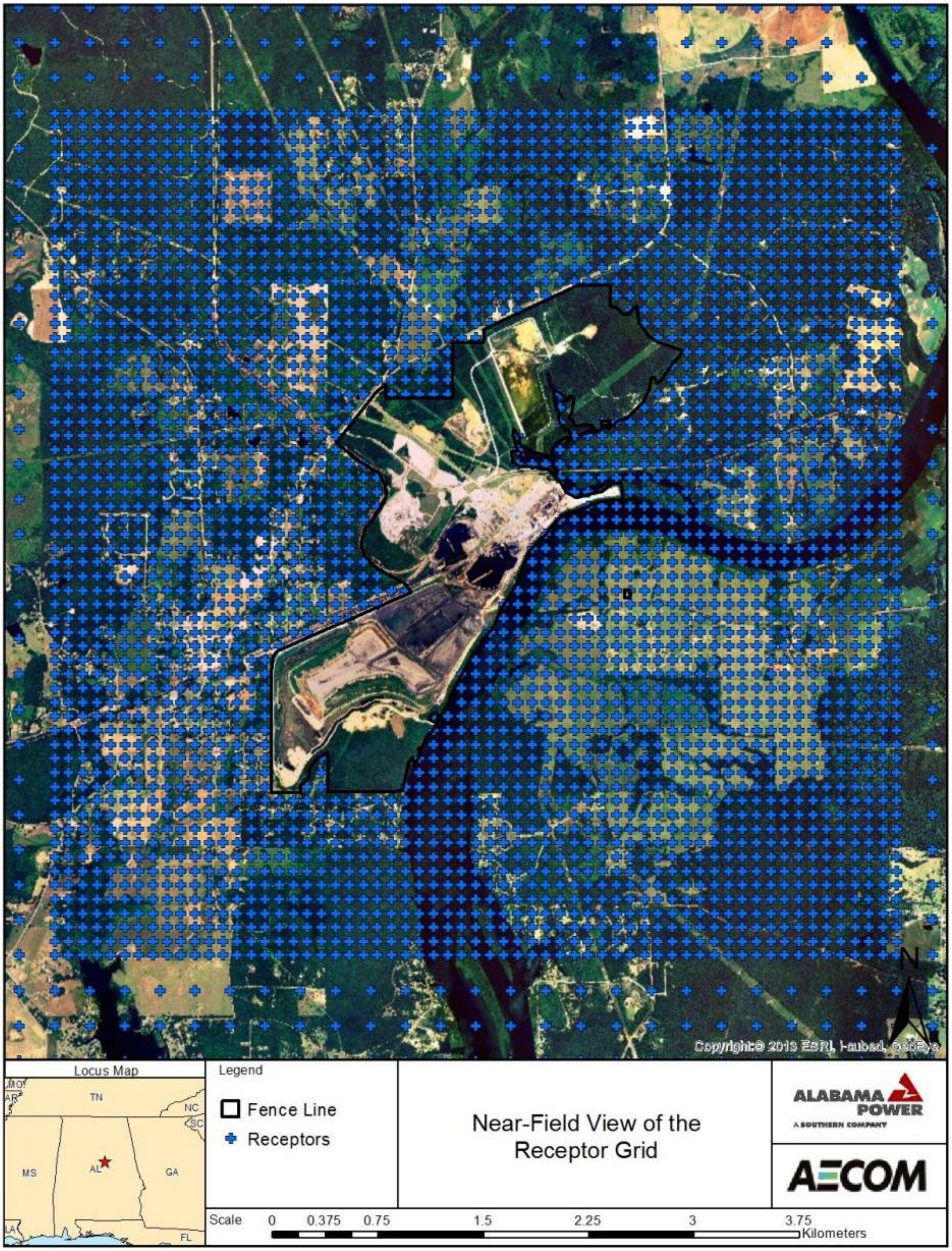


Figure 3-5 Far-Field Receptor Grid for Plant Gaston

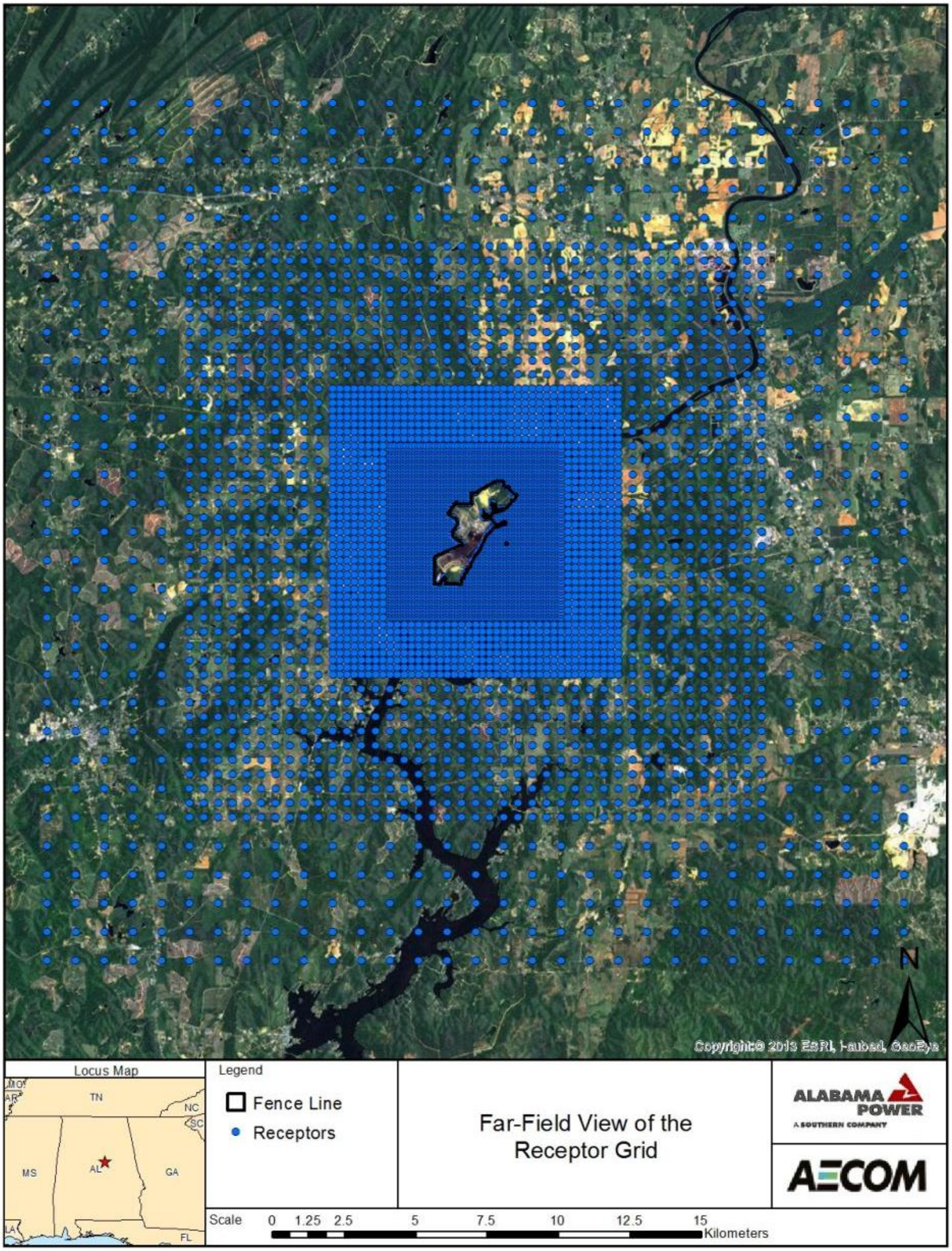
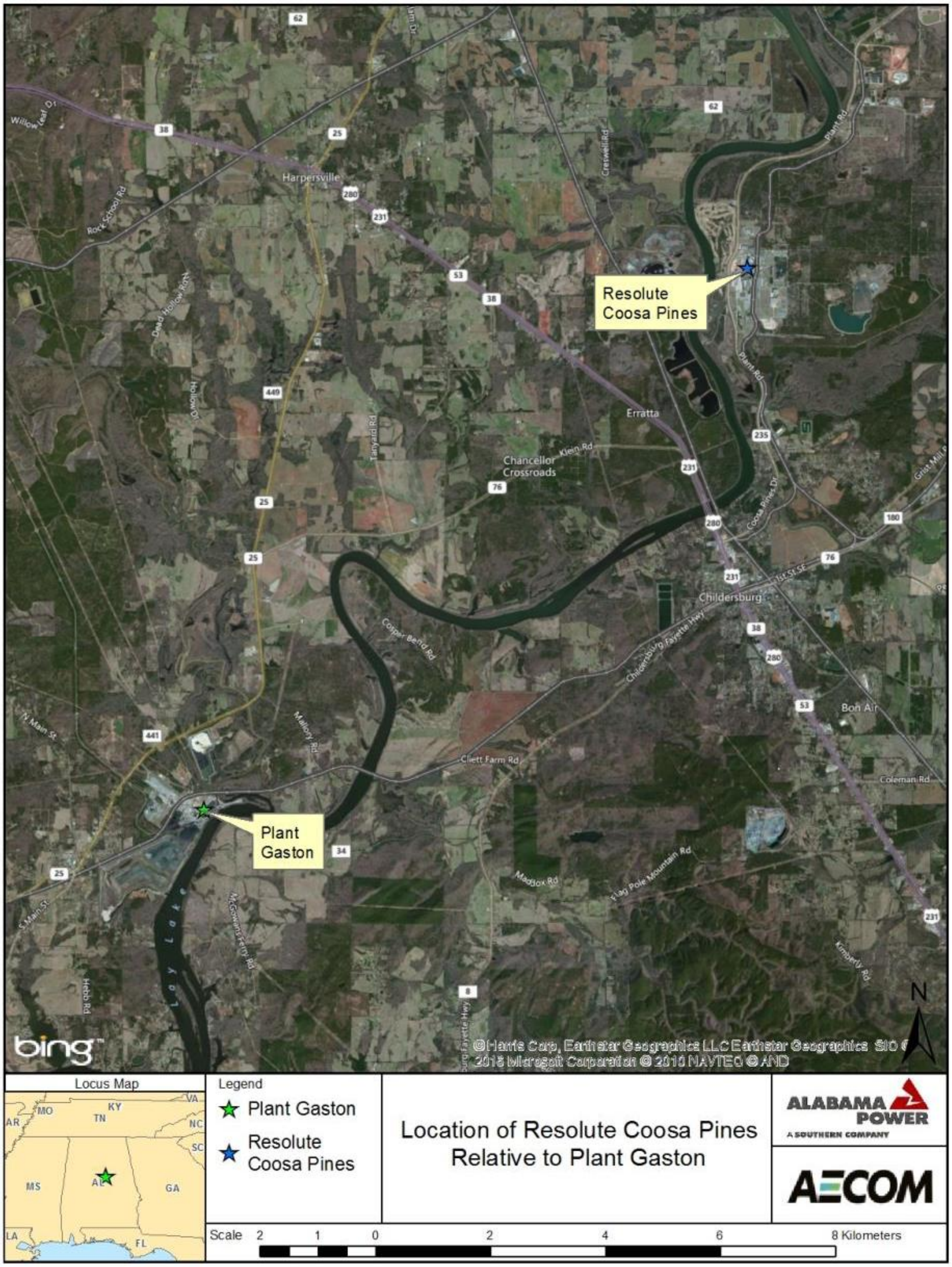


Figure 3-6 ADEM Recommended Meteorological Station for Modeling

Figure 3-7 Location of Meteorological Sites Relative to Plant Gaston

Figure 3-8 Location of Background Source for Plant Gaston SO_2 DRR Modeling



4.0 Analysis of Modeling Results

The modeling results for 1-hour SO_2 concentrations are presented in Table 4-1 and are based on the sum of the modeled design concentration for Plant Gaston using actual hourly emissions from 2012-2014 for Unit 5 and the CT and potential emission rates from Units 1-4 plus the ambient background concentration. The modeled design concentration was calculated by AERMOD and reflects the three-year average of the 99^{th} percentile ranked peak daily 1-hour SO_2 concentration.

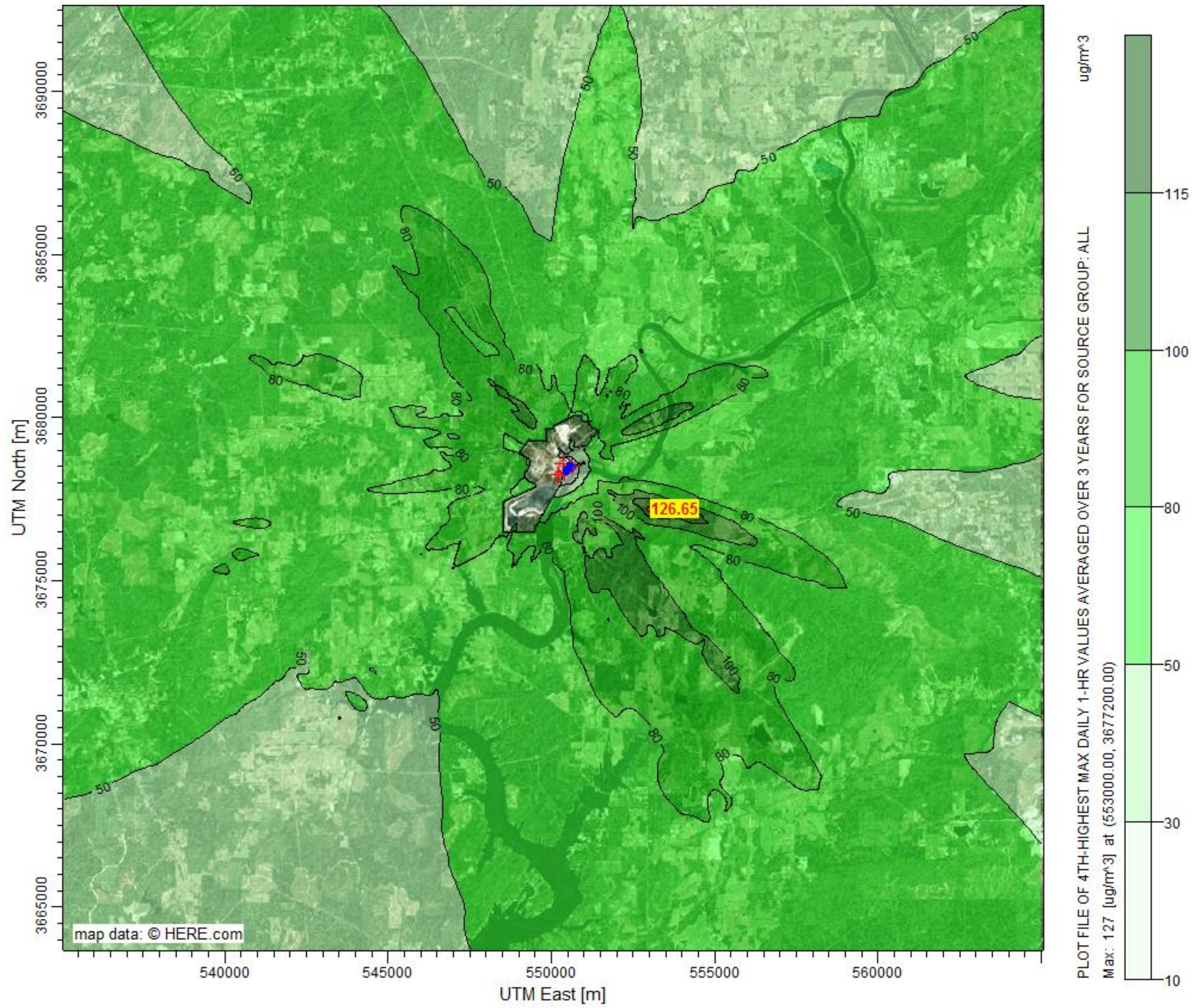
Table 4-1 compares the total concentration (modeled plus background) with the 1-hour SO_2 NAAQS of 196.5 $\mu g/m^3$. Figure 4-1 shows the location of the maximum modeled concentration, which is approximately 2.7 km east-southeast of the eastern edge of the Plant Gaston plant boundary. The location of maximum design concentration is within 100-m spaced receptors.

As shown in Table 4-1, the modeling results indicate that all areas surrounding the Plant Gaston are below the applicable NAAQS standard and should be designated as attainment. The modeling archive (see Appendix C) contains all the electronic files needed to review and reproduce the results contained in this report.

Table 4-1 Summary of 1-hour SO_2 NAAQS Analysis

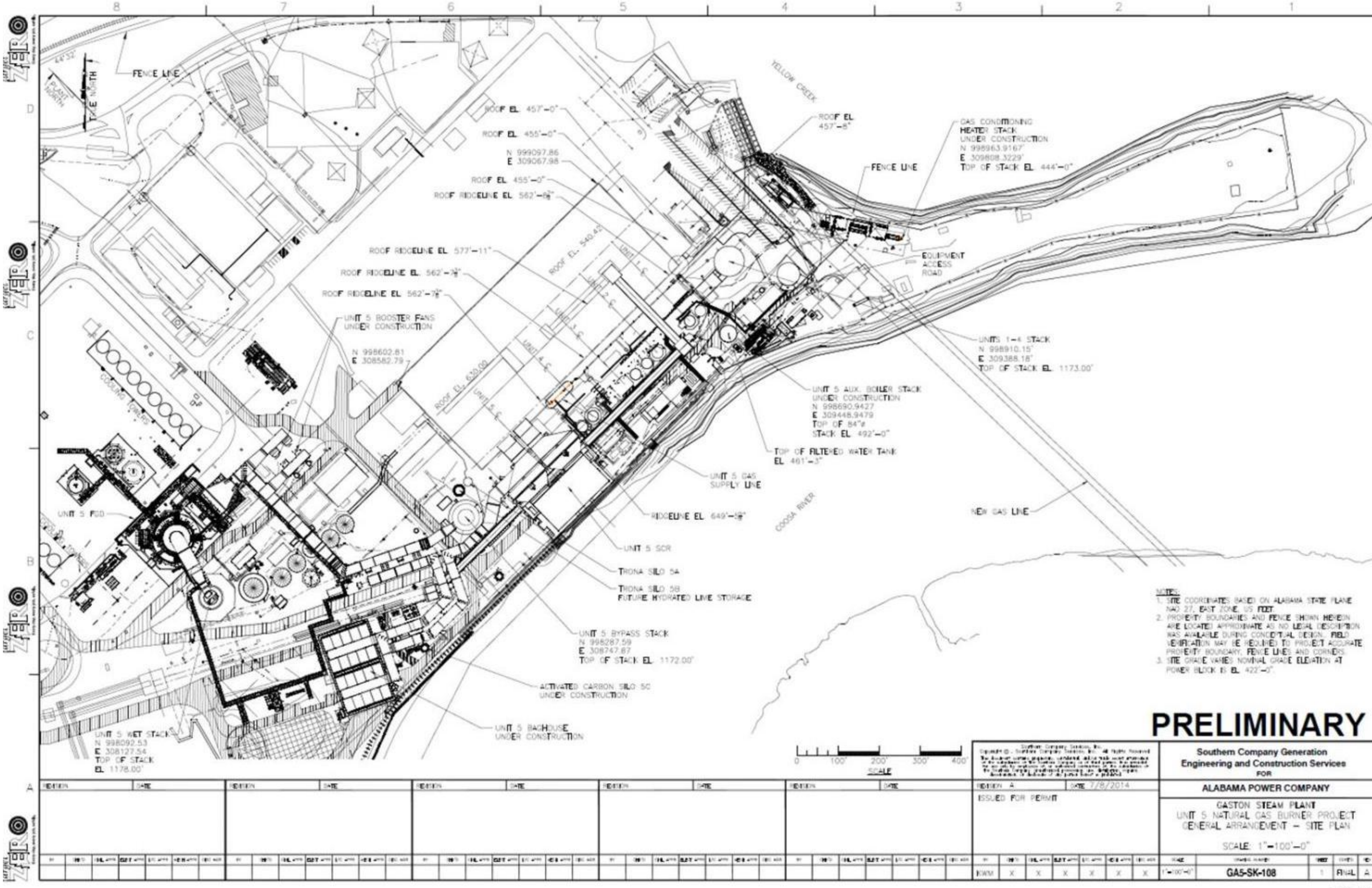
Pollutant	Averaging Period	Model Design Concentration ($\mu g/m^3$)	Monitored Background Concentration ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	Below NAAQS (Yes/No)	Percent of NAAQS (%)
SO_2	1-hour	118.80	7.85	126.65	196.5	Yes	65%

Figure 4-1 Isopleth Map of 1-hour SO_2 NAAQS Total Concentrations (Modeled + Background)



Appendix A

Plant Gaston – Facility Plot Plan



FENCE LINE
ROOF EL 457'-0"
ROOF EL 455'-0"
N 999097.86
E 309067.98
ROOF EL 455'-0"
ROOF RIDGELINE EL 562'-6⅝"
ROOF RIDGELINE EL 577'-11"
ROOF RIDGELINE EL 562'-7⅝"
ROOF RIDGELINE EL 562'-7⅝"
UNIT 5 BOOSTER FANS
UNDER CONSTRUCTION
N 998602.81
E 308582.79
YELLOW CREEK
ROOF EL
457'-8"
FENCE LINE
GAS CONDITIONING
HEATER STACK
UNDER CONSTRUCTION
N 998963.9167'
E 309808.3229'
TOP OF STACK EL 444'-0"
EQUIPMENT
ACCESS
ROAD
UNITS 1-4 STACK
N 998910.15'
E 309388.18'
TOP OF STACK EL 1173.00'
UNIT 5 AUX. BOILER STACK
UNDER CONSTRUCTION
N 998690.9427
E 309448.9479
TOP OF 84"ø
STACK EL 492'-0"
TOP OF FILTERED WATER TANK
EL 461'-3"
UNIT 5 GAS
SUPPLY LINE
COOSA RIVER
NEW GAS LINE
RIDGELINE EL 649'-5⅜"
UNIT 5 FGD
UNIT 5 SCR
TRONA SILO 5A
TRONA SILO 5B
FUTURE HYDRATED LIME STORAGE
UNIT 5 BYPASS STACK
N 998287.59
E 308747.67
TOP OF STACK EL 1172.00'
ACTIVATED CARBON SILO 5C
UNDER CONSTRUCTION
UNIT 5 BAGHOUSE
UNDER CONSTRUCTION
UNIT 5 WET STACK
N 998092.53
E 308127.54
TOP OF STACK
EL 1178.00'
COOLING TOWERS
NOTES:
1. SITE COORDINATES BASED ON ALABAMA STATE PLANE NAD 27, EAST ZONE, US FEET.
2. PROPERTY BOUNDARIES AND FENCE SHOWN HEREON ARE LOCATED APPROXIMATE AS NO LEGAL DESCRIPTION WAS AVAILABLE DURING CONCEPTUAL DESIGN. FIELD VERIFICATION MAY BE REQUIRED TO PROJECT ACCURATE PROPERTY BOUNDARY, FENCE LINES AND CORNERS.
3. SITE GRADE VARIES. NOMINAL GRADE ELEVATION AT POWER BLOCK IS EL 422'-0".
PRELIMINARY
0 100' 200' 300' 400'
SCALE
REVISION A DATE 7/8/2014
ISSUED FOR PERMIT
Southern Company Generation
Engineering and Construction Services
FOR
ALABAMA POWER COMPANY
GASTON STEAM PLANT
UNIT 5 NATURAL GAS BURNER PROJECT
GENERAL ARRANGEMENT – SITE PLAN
SCALE: 1"=100'-0"
GA5-SK-108
FINAL

Appendix B

GEP Documentation for the Plant Gaston Units 1-4 Stack and Unit 5 Stack

Alabama Power Company
600 North 18th Street
Post Office Box 2641
Birmingham, Alabama 35291
Telephone 205 250-1000

TO: Bryan Baldwin
SCS-R&D

Alabama Power

December 31, 1985

Mr. Richard E. Grusnick, Chief
Air Division
Alabama Department of Environmental Management
1751 Federal Drive
Montgomery, Alabama 36130

Dear Mr. Grusnick:

My letter of December 11, 1985 provided information for Barry, Gadsden and Gorgas Steam-Electric Generating Plants. Attached are the documents for Gaston, Greene County and Miller Steam-Electric Generating Plants concerning the Stack Height Regulations promulgated by the Environmental Protection Agency on July 8, 1985:

1. Determination of Good Engineering Practice Stack Heights for Stacks Greater than 65 Meter-APC200 forms for the Greene County, Gaston and Miller Steam-Electric Generating plants and supporting documentation.

2. Emission data for the Gaston and Greene County Plants.

As noted on the APC-200 forms, the stacks at the Miller Steam Plant are less than Good Engineering Practice stack height and no additional modeling will be required to prove compliance with the regulations.

We request a meeting to discuss this information and the modeling requirements as soon as possible. If you have any questions, please call me.

Sincerely,

William L. Bowers

W. L. Bowers

WDH:dy

Attachments

cc: Mr. Paul Pate - Jefferson County Health Department - Miller Steam Plant

DETERMINATION OF GOOD ENGINEERING PRACTICE STACK HEIGHT
FOR STACKS GREATER THAN 65 METERS

1. Company Alabama Power Company

2. Address P. O. Box 2641, Birmingham, Alabama 35291

3. Permit Unit/Source Description Gaston Steam Plant Units 1-4

   (a) Actual stack height above grade 749.3

   (b) List the air emission sources which utilize this stack. Describe the air pollution control system. Attach diagrams or further explanation as needed. Gaston Steam Plant Units 1,2, 3 and 4

   all with electrostatic precipitators

4. Attach a top-view schematic drawing of the plant (drawn-to-scale) including geographical orientation. Label all buildings and stacks. Include height, width, and length of all buildings.

5. (a) GEP stack height 555 feet

   (b) Date construction started on stack September, 1974

   (c) In the space provided below or in attachments show the GEP calculations and indicate the building used.

$GEP_H = 2.5H$
$= 222\ (2.5)$
$= 555$ feet

(See attached drawing)

The buildings used were the Unit No. 5 boilerhouse and ESP

6. Highest terrain elevation within 1/2 mile:

   (a) Height 480

   (b) Distance and direction from stack Northeast 0.5 miles

   (from U. S. Geological Map Quad Wilsonville)

W. L. Bowers

Name of Company Official

[illegible]

Signature

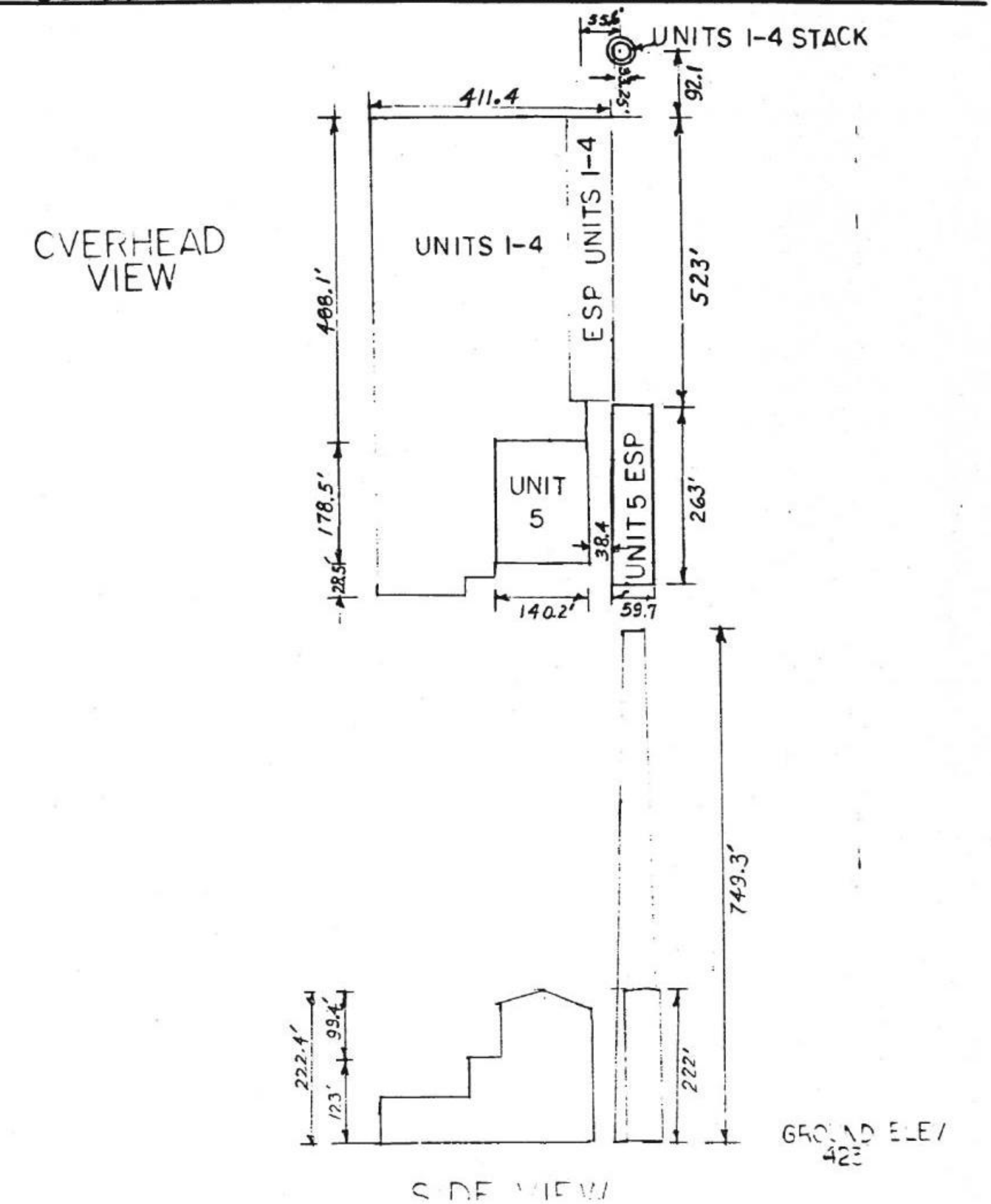
[illegible]

Date

APC-200

Design Calculations Alabama Power

Project GASTON STEAM PLT.	Prepared By	Date
Subject/Title GEP STACK HEIGHT	Reviewed By	Date
SCALE - 1 INCH = 200 FT	Calculation Number	Sheet of



DETERMINATION OF GOOD ENGINEERING PRACTICE STACK HEIGHT
FOR STACKS GREATER THAN 65 METERS

1. Company Alabama Power Company

2. Address P. O. Box 2641 Birmingham, Alabama 35291

3. Permit Unit/Source Description Gaston Steam Plant - Unit 5

   (a) Actual stack height above grade 750 feet

   (b) List the air emission sources which utilize this stack. Describe the air pollution control system. Attach diagrams or further explanation as needed. Gaston Steam Plant Boiler 5 with electrostatic precipitators

4. Attach a top-view schematic drawing of the plant (drawn-to-scale) including geographical orientation. Label all buildings and stacks. Include height, width, and length of all buildings.

5. (a) GEP stack height Grandfathered

   (b) Date construction started on stack June 1, 1970

   (c) In the space provided below or in attachments show the GEP calculations and indicate the building used.

See supporting documentation on grandfathering

6. Highest terrain elevation within 1/2 mile:

   (a) Height 460

   (b) Distance and direction from stack West northwest 0.3 miles (from U.S. Geological Map Quad Wilsonville)

W. L. Bowers
Name of Company Official

[signature]
Signature

12/30/85
Date

APC-200

Appendix C

Electronic Modeling Archive

(See attached web link in transmittal email to download files)